

Lab No. 3: Implementation of a Local Network on Windows and Linux

Lab Objectives

- Identify the type of network card in a machine.
- Create a network between two machines using a P2P architecture.
- Establish physical connections between different network stations and peripherals.
- Configure IP addresses and learn basic network testing commands on Windows and Linux.
- Share resources within a local network.

Required Resources

The hardware used during these practical sessions includes:

- 14 computers, each equipped with a wired network interface (PCI network card) and two operating systems (LINUX Fedora 10 and Windows XP).
- RJ45 cables for the wired network.
- 2 switches for interconnecting the machines.

Lab Procedure

After identifying the type of network card in each machine available in the lab, the objective of this practical session is to:

- Create a local network on Windows, then on Linux.
- Use basic commands to test the network.
- Share resources within the local network.

I. Theoretical Part

I.1. Network Interface Card (NIC)

A network interface card (NIC) is a device that allows a computer to connect to a network. The Ethernet card, which complies with the IEEE 802.3 standard, is the most common device used in PCs to create a local network.

Each NIC has a unique address called a MAC address (Media Access Control address), which identifies it among all other machines on the network. This address is assigned by the manufacturer and is embedded in the card's chip.



I.2. Local Network

A local network (LAN) is a group of computers and devices installed within a relatively limited area, connected by a communication link that allows them to interact with one another.

A local network typically consists of personal computers and shared resources such as printers and hard drives.

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The various devices in a local network are called **nodes**, which are interconnected by cables that transmit messages.

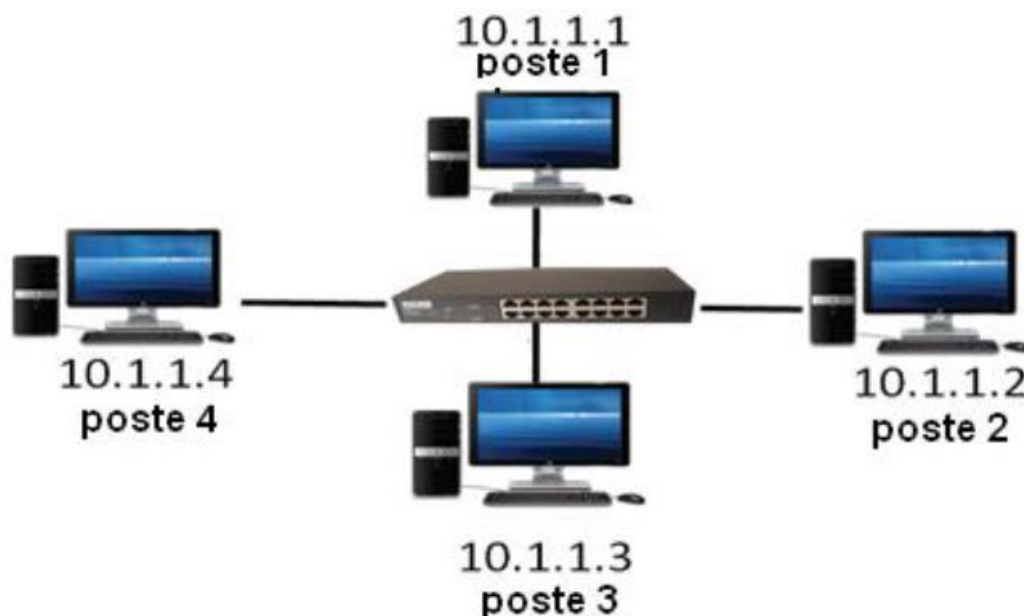


Figure 1: Local Network with a Star Topology

II. Practical Part

II.1. Creating a Local Network on Windows

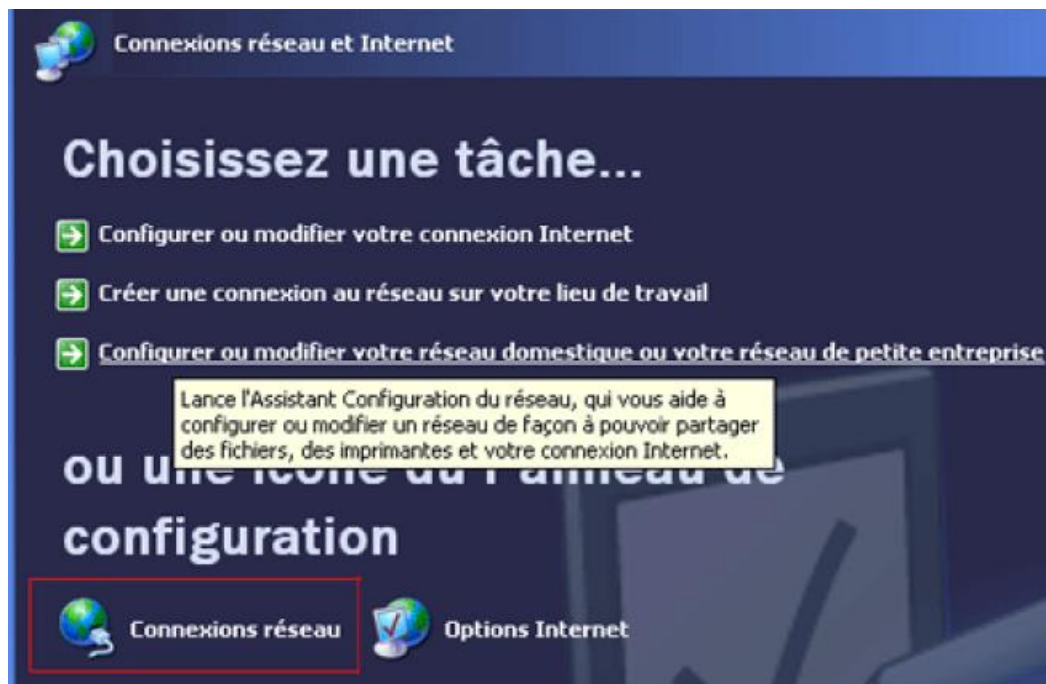
II.1.1. Identifying the Network Card Type

1. Open the **Device Manager** to check if a network card is available:
 - Go to **Start** → **Run** → type *devmgmt.msc* → **Enter**.
2. Display the **MAC (physical) address** of the network card for each computer:
 - Go to **Start** → **Run** → type *cmd* → **Enter**.
 - In the command prompt, type: *ipconfig /all*
 - Press **Enter** to view the network adapter details, including the MAC address.

II.1.2. Implementing a Local Network on Windows

1. **Physically connect** the computers using a **switch** and **straight-through cables**, as shown in Figure 1.
2. Once all the hardware is installed and connected, go to the **Windows Control Panel**, then select **Network and Internet Connections**.

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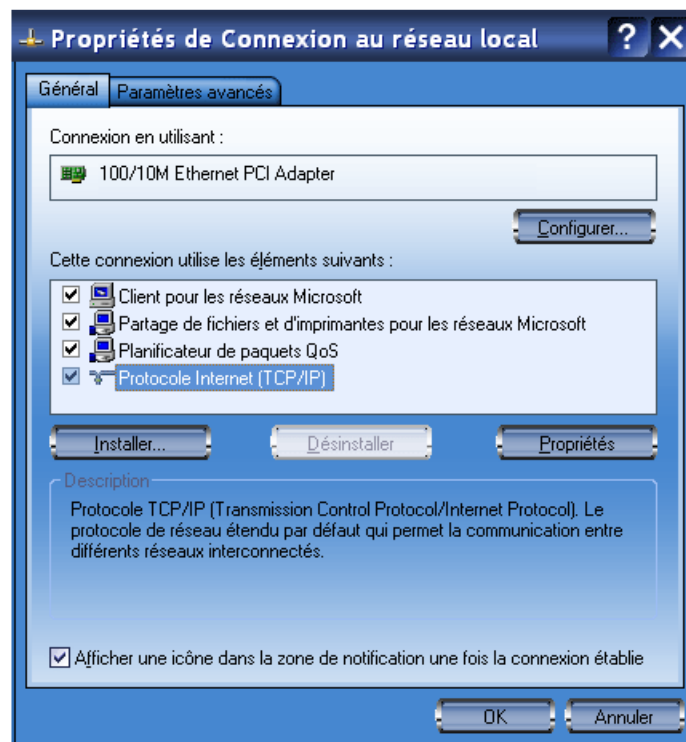


3. Open the **Network Connections** section.

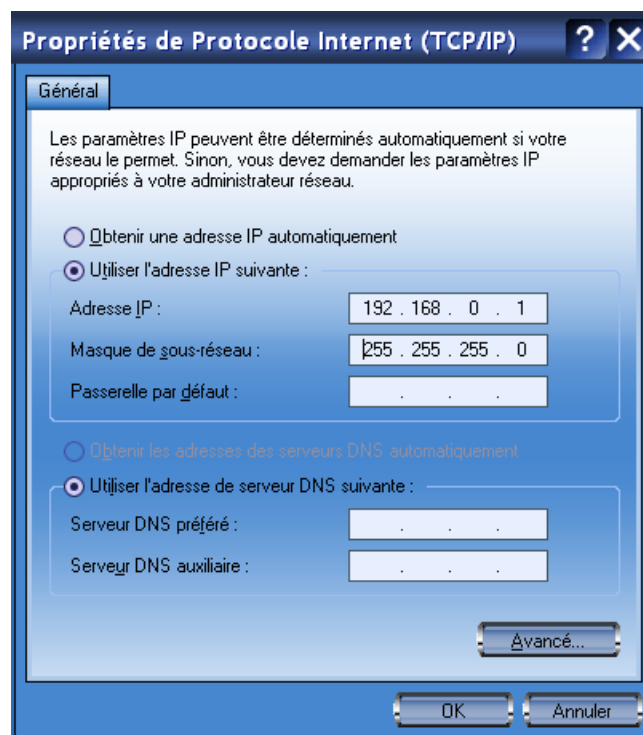


4. Right-click on your **network connection**, select **Properties** (this connection must be active).

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5. Select **Internet Protocol (TCP/IP)** and click the **Properties** button.
6. On **computer 1**, check the box "Use the following IP address", then enter:
 - **IP Address:** 10.1.1.1
 - **Subnet Mask:** 255.255.255.0



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The **IP address** is a unique identifier for a computer in a TCP/IP network. Each machine must have a different IP address.

- On the other computers, assign the following IP addresses:
 - **PC 2:** 10.1.1.2
 - **PC 3:** 10.1.1.3
 - **PC 4:** 10.1.1.4
 - **... PC 14:** 10.1.1.14
 - All computers must use the **same subnet mask:** 255.255.255.0.

Click **OK** to confirm.

7. Finally, enter **10.1.1.1** as the **Default Gateway** and **Preferred DNS Server** on all computers in the network.

II.1.3. Identifying the Characteristics of the Installed Local Network

1. On the desktop, double-click the **Network Favorites** icon, then double-click the **Local Area Connection** icon to view the connection details (status, duration, speed) and its activity (packets sent/received).
2. In the **Connection Status** window, click the **Support** tab. In the **Connection Status** area, you will find the **Details** button, which provides the following properties:

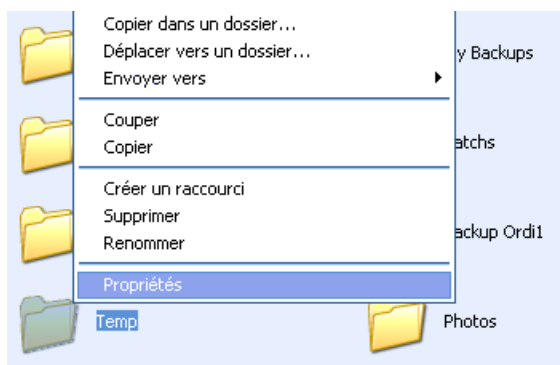
Property	Value
Physical Address	
IP Address	
Subnet Mask	
Default Gateway	
DHCP Server	
DNS Server	
WINS Server	

II.1.4. Sharing Folders and Printers in a Local Network

II.1.4.1 Sharing a Folder on the Network

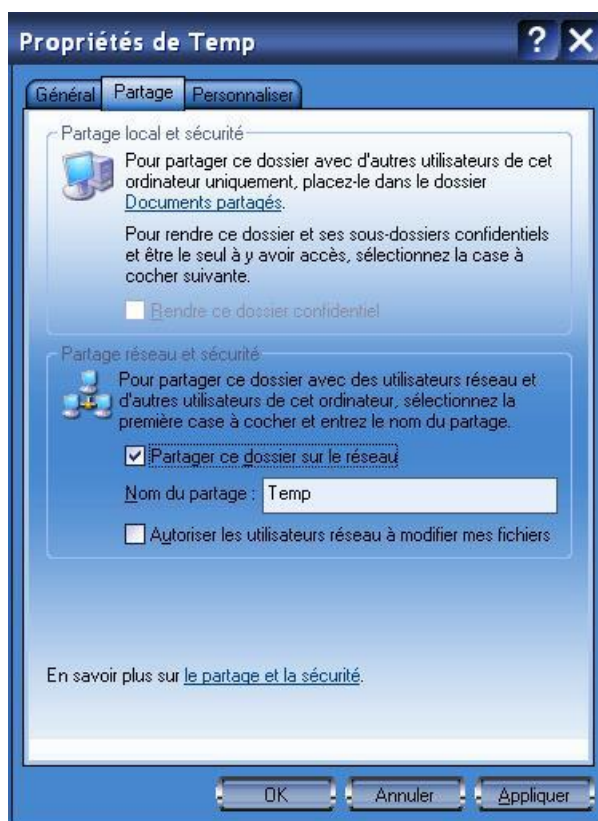
1. Right-click on the **folder** you want to share, and select **Properties**.

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2. Go to the **Sharing** tab.

- Check the box: **Share this folder on the network**.
- In the **Share Name** field, enter a name for the folder on the network.
- The "Allow network users to change my files" option allows others on the network to modify your files. It is recommended not to select this option for security reasons.



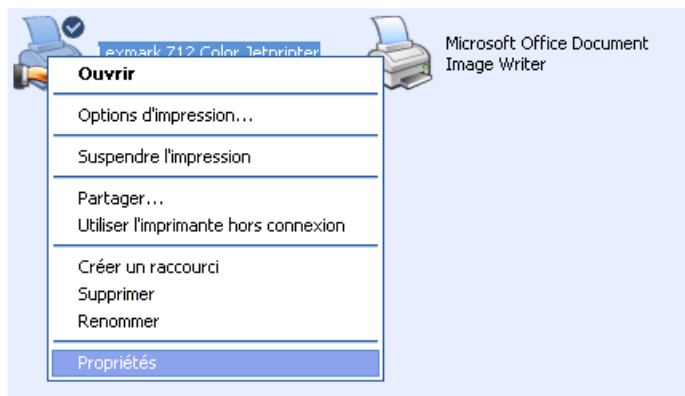
II.1.4.2. Sharing a Printer on the Network

1. On the PC that has the printer, go to the **Control Panel**, and select **Printers and Other Devices**.

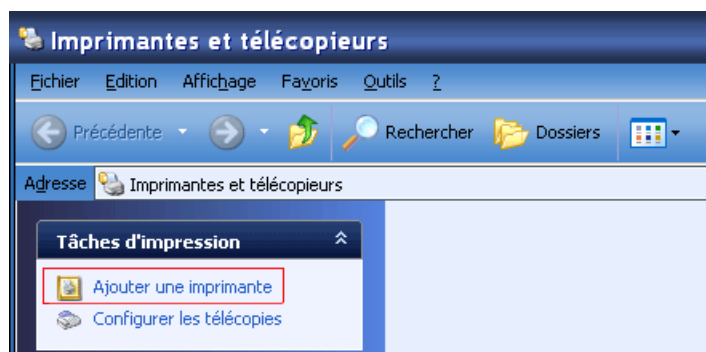


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2. Now, go to the **Printers and Faxes** section.
- Right-click on your printer and select **Properties**.



3. In the **Sharing** tab, check the box **Share this printer**. Give the printer a name (e.g., **Printer on PC1**).
4. On the client PCs, go to the **Printer Options** (Control Panel → Printers and Other Devices → Printers and Faxes).
- Launch the **Add Printer Wizard**.



5. Click **Next** in the window that appears, then select the option "**A network printer or a printer connected to another computer**", and click **Next** to continue. Check the option "**Connect to this printer**".
6. In the **Name** field, enter this format: **computer name printer name** (for example: **ordi1imprim1** where the PC with the printer is called **ordi1** and the printer is named **imprim1**).
7. Click **Next** to continue.
The printer will then be installed, and it will appear in the **Printers** folder.

II.2. Network Test and Useful Commands (in MS-DOS)

- **Ping**: This command checks if a computer is reachable within the local network.
The syntax is: **Ping [remote machine name]**

You can also specify an **IP address** instead of the machine name.

- **Ipconfig**: The **ipconfig** command displays the current network configuration values.
When used without parameters, **ipconfig** shows the **IP address**, **subnet mask**, and **default gateway** for all network cards.

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It can also be used with options to view more specific details.

II.3. Implementing a Local Network on Linux

II.3.1 Network Interface

In the Linux system, the **network interface** is physically represented by the network card, but the term "network interface" is also used to refer to a software name to which an IP address is assigned (e.g., **eth0**).

An **IP address** is always assigned to a **network interface**, not to a computer.

➤ Interface Information

To check the status of all interfaces, you can use the command:

netstat -i

II.3.2 Dynamic Configuration of Machines with ifconfig

The **ifconfig** command allows configuring a network interface. Ethernet interfaces are labeled as **ethx**, where **x** takes values like 0, 1, 2, etc. The first interface is named **eth0**.

To assign the address **10.1.1.1** to the first interface of our machine, we use the following command:

\$ ifconfig eth0 10.1.1.1 netmask 255.255.255.0 broadcast 10.1.1.255

Since the values given are standard (the **netmask** and **broadcast** match those corresponding to the previous IP address), you could simply type:

\$ ifconfig eth0 10.1.1.1

To change the IP configuration of an interface dynamically, use:

\$ ifconfig <interface> <IP address>

II.3.3 The File /etc/sysconfig/network-script/ifcfg-eth0

You can also configure the machine's addresses by editing the file:

/etc/sysconfig/network-script/ifcfg-eth0

Example Configuration of an Interface in /etc/sysconfig/network-script/ifcfg-eth0:

```
auto eth0
iface eth0 inet static
address 10.1.1.1
netmask 255.255.255.0
gateway 10.1.1.1
```


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II.3.4 Identifying Machines by a Symbolic Name

The file `/etc/hostname` contains the machine's name. To change the hostname, simply edit this file. However, this change will not be immediately recognized by the system; it will take effect after the next reboot or by running:

```
/etc/init.d/hostname.sh
```

You can also change the hostname with the command:

```
hostname <hostname>
```

But the change will not be saved after a reboot.

II.3.5 Network Control

To check if the network card is working, try to communicate with another machine using the command:

```
Ping <IP address>
```

The **Ping** command (which works similarly to the one in Windows) sends a packet to the specified **IP address** and waits for a response. It then displays the time taken for the entire operation in milliseconds.

Note: Don't forget to use the **manual pages** in Linux:

```
man <command name>
```